# Origin of the January-Mach 2004 strong $NO_2$ enhancement in the northern polar stratosphere using MIPAS and GOMOS data

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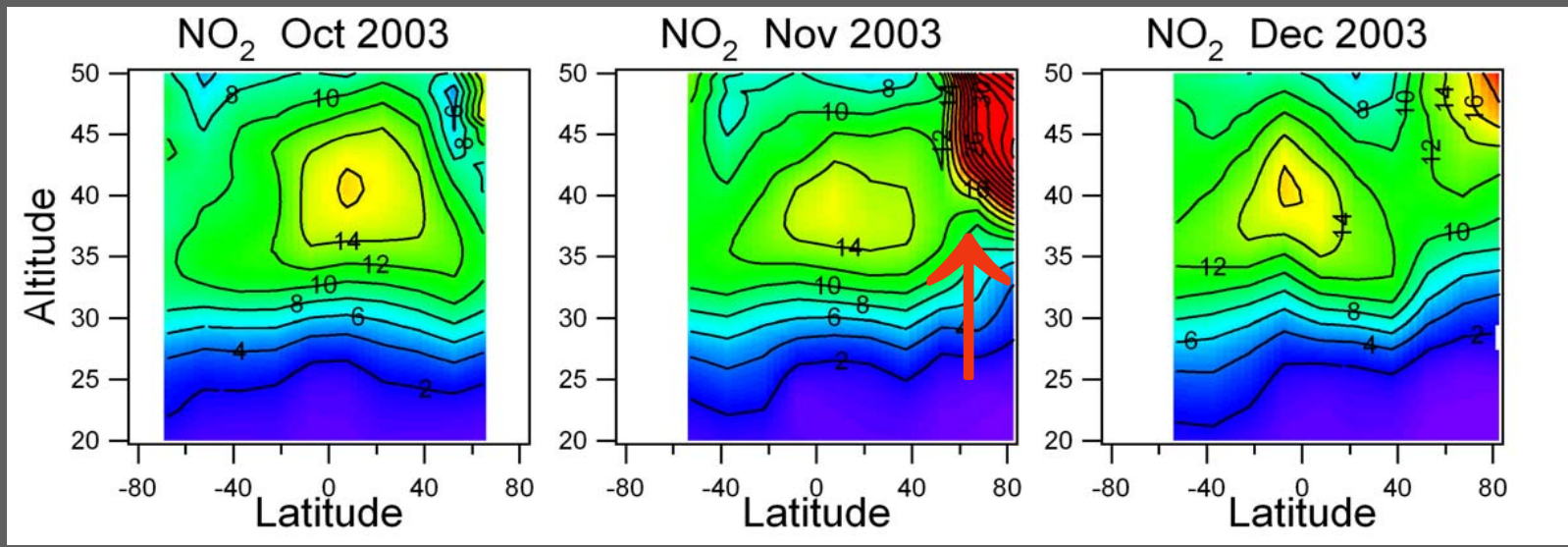
$NO_2$ enhancements are sometimes observed in the middle stratosphere during polar winter, due to strong solar flares (protons flux)

October-November 2003 event in Artic:




GOMOS nighttime data (ppbv), Hauchecorne et al., JGR, 2005

Persistence of this Arctic $NO_2$ enhancement in Spring 2004 observed by many satellite instruments

Origin of the persistence is unknown

Gaps in polar latitudes coverage using solar occultation instruments (e.g. SAGE)

Necessity of nighttime measurements

Two instruments onboard ENVISAT:

GOMOS : star occultation method – UV visible

MIPAS : Infra red limb sounder

Validation by UV-visible balloon-borne instrument SALOMON (Moon occultation)

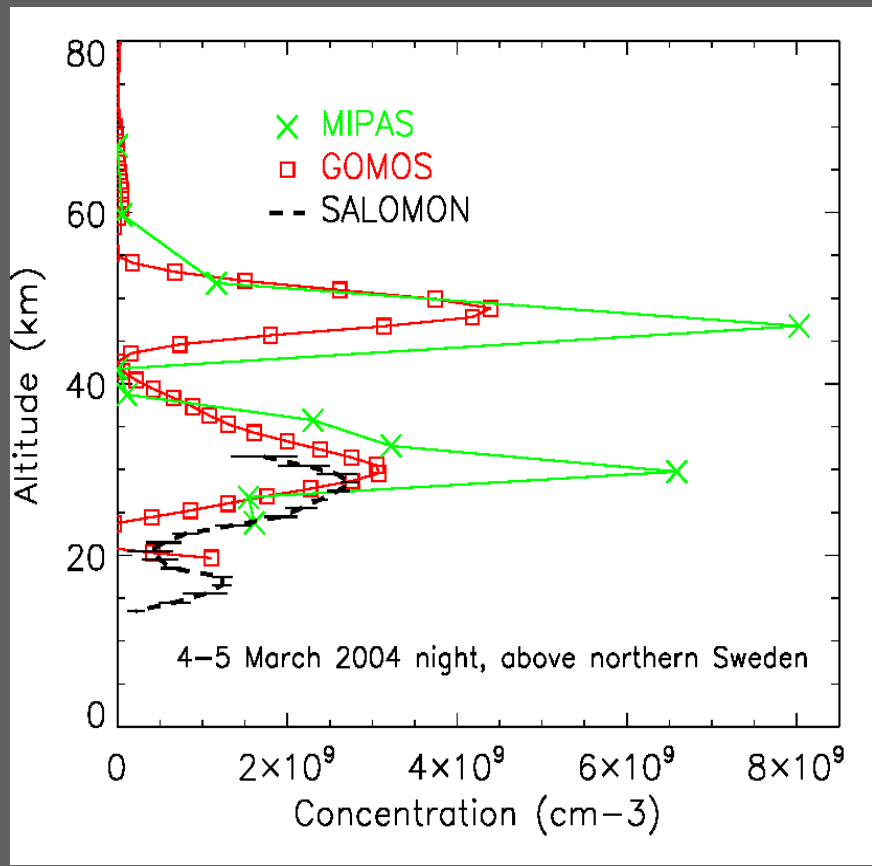

SALOMON gondola

# March 2004: comparison between MIPAS, GOMOS and SALOMON

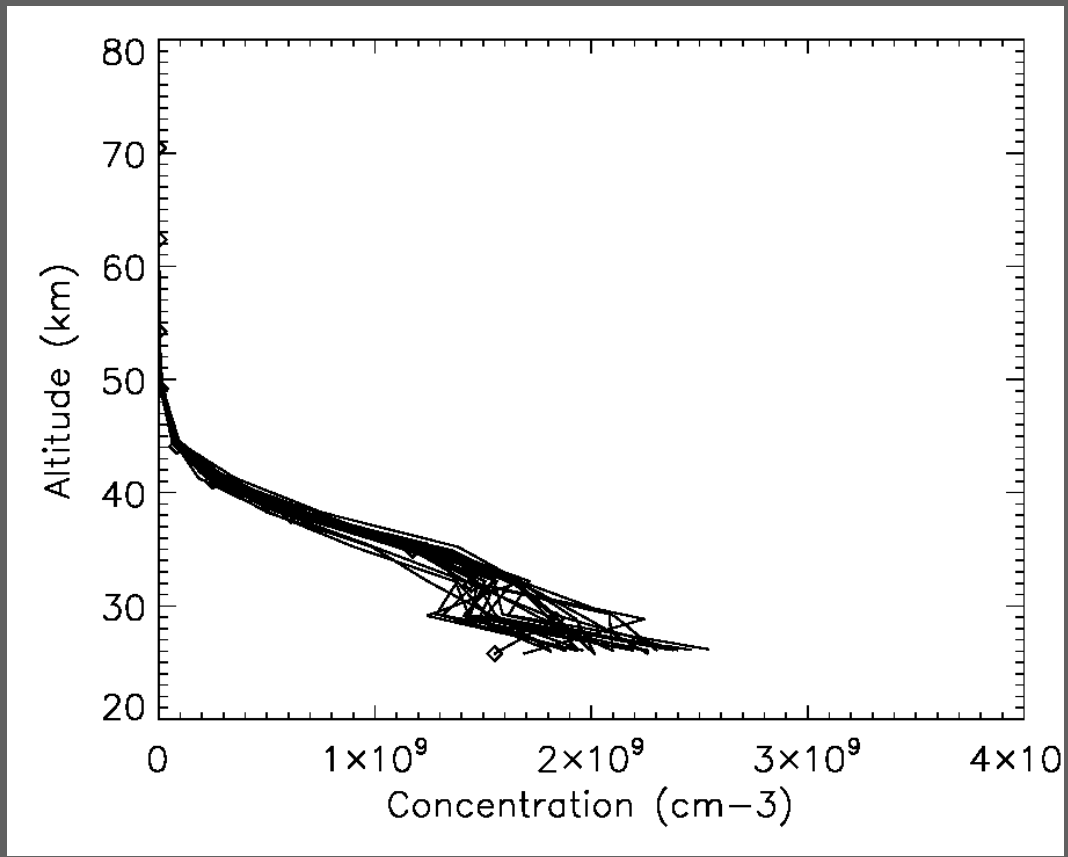
Detection of the $NO_2$ enhancement above 40 km

Uncertainties on MIPAS absolute values:

- poor vertical resolution above 40 km
- overestimation of concentrations by a factor 2



# No peak for $NO_2$ in the MIPAS data at southern polar latitudes in January – April 2004




January-February 2004 data

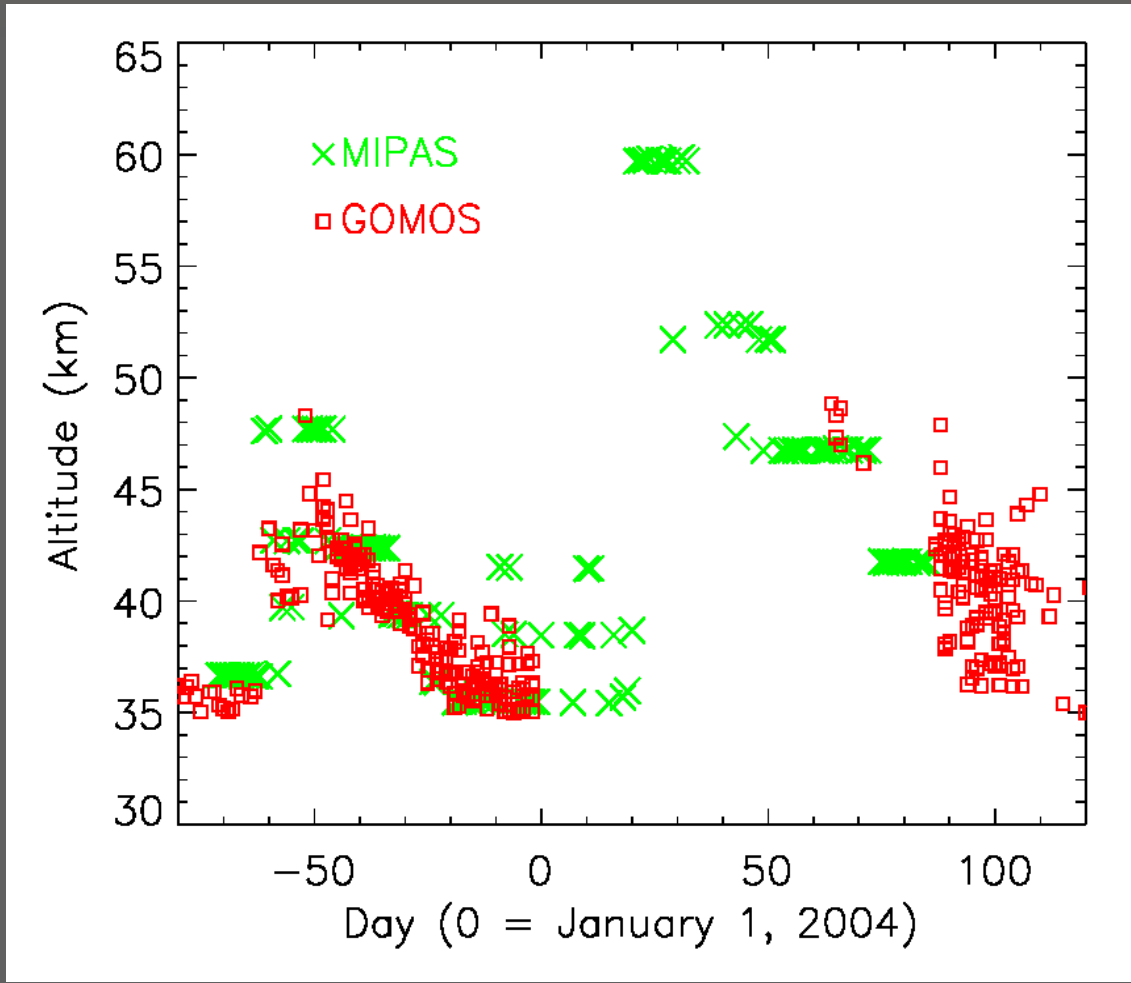
GOMOS data for January-April 2004 not yet available (except sparse data at the beginning of March 2004)

MIPAS data must be used cautiously

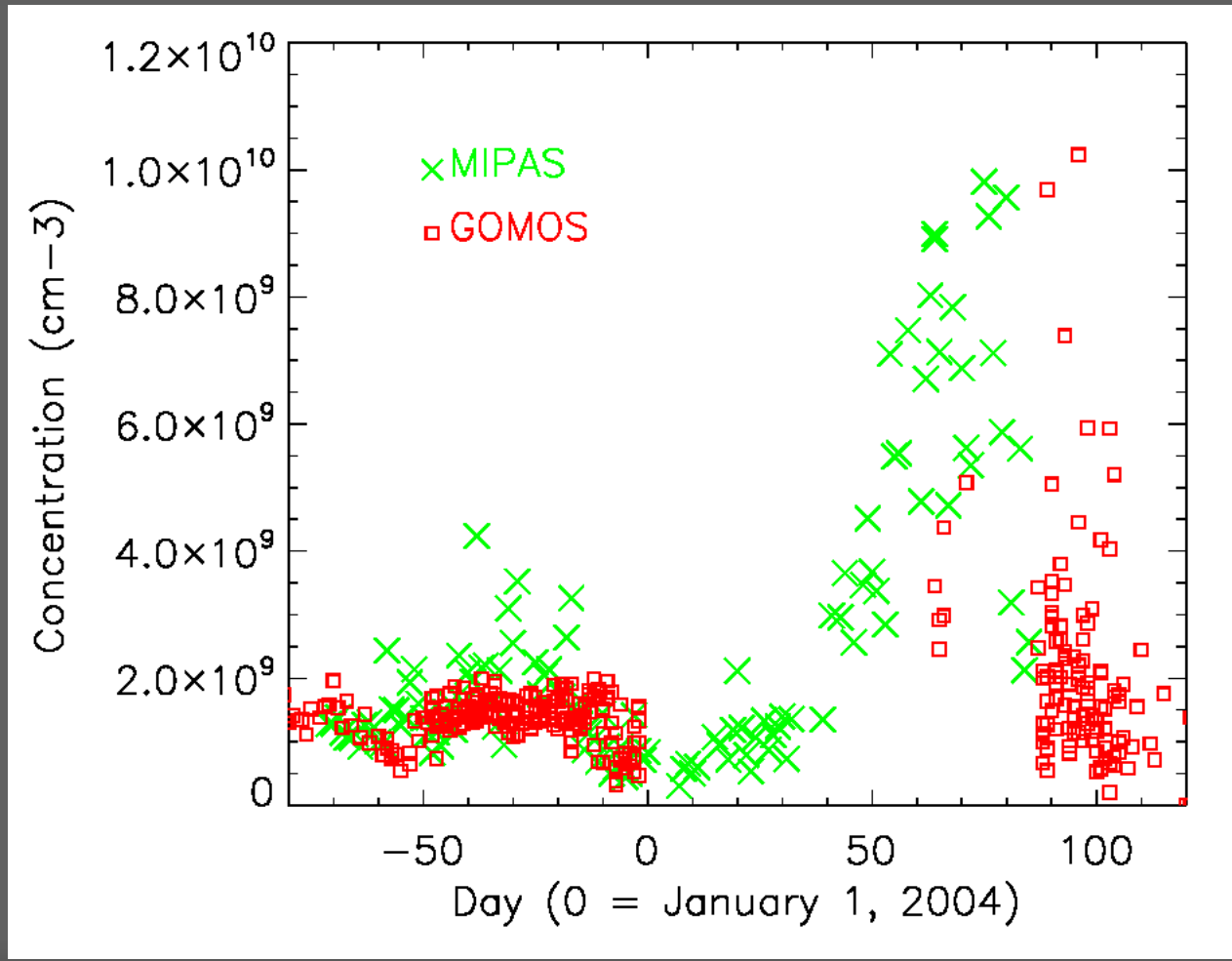
Nevertheless, the analysis of the $NO_2$ persistence can be conducted …

# Two $NO_2$ enhancements in the October 2003 - April 2004 period

Downward transport in the stratosphere of 250±50 m per day



# Second enhancement stronger than the first one, and at higher altitude

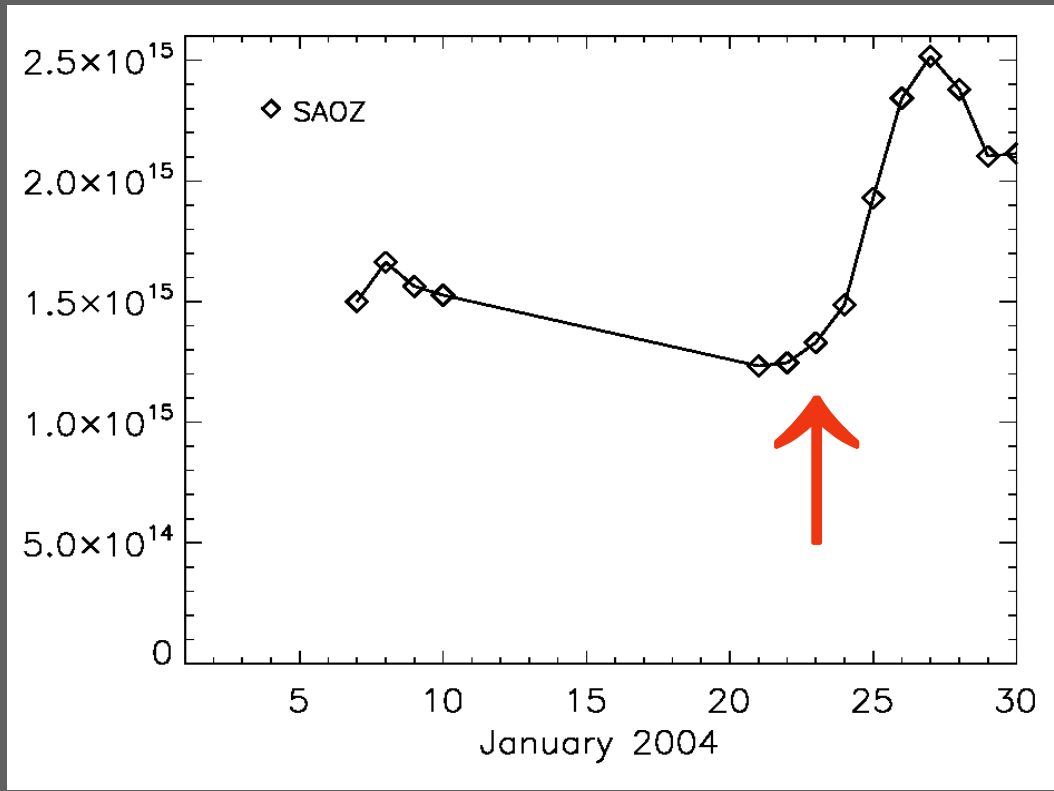


Different nature and origin
for the two $NO_2$ enhancements

No major solar flare in January 2004 !

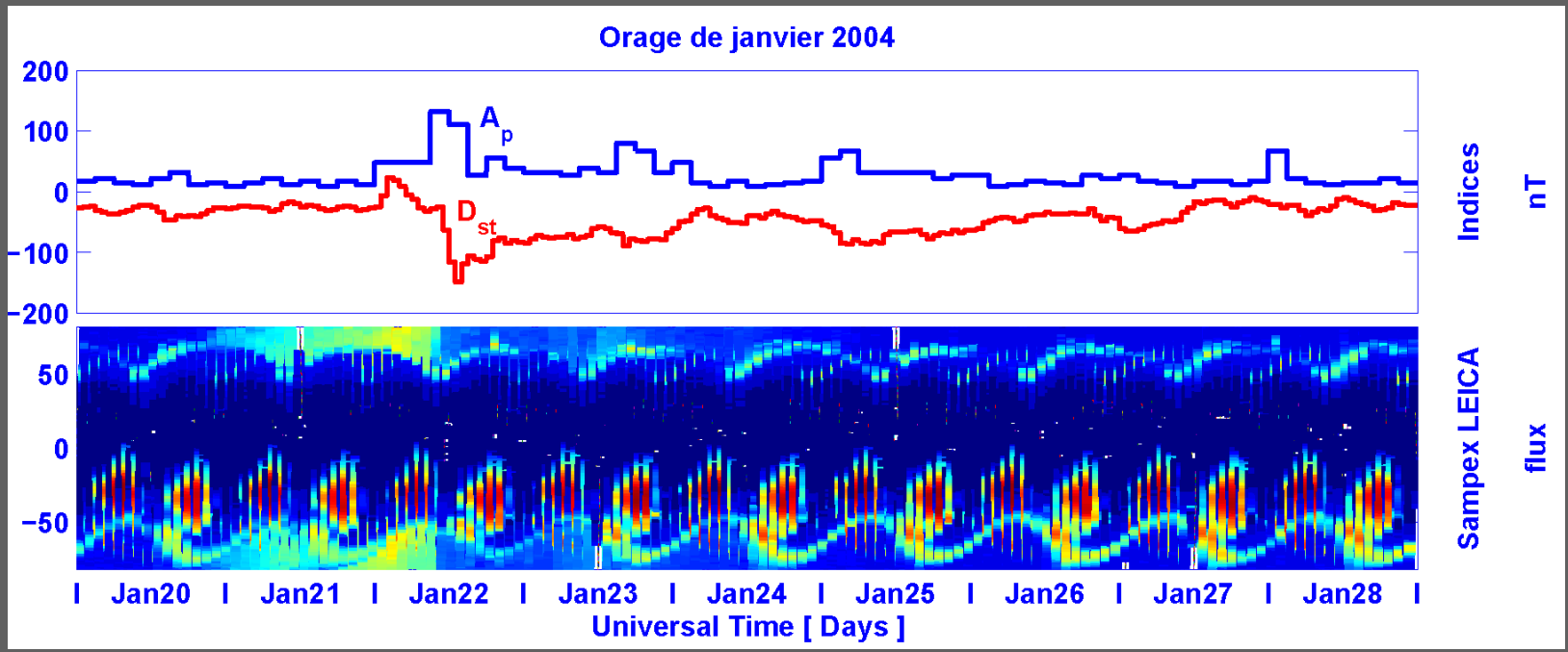
# Starting date of the second enhancement: 23 January 2004

Ground-based measurements of $NO_2$ columns by the spectrometer SAOZ



# Solar coronal mass ejection on 20 Jan. 2004 (01:00 UT)

Effect on Earth magnetosphere on 22 Jan. (01h40 UT), and magnetic storm




SAMPEX satellite data

No proton detection

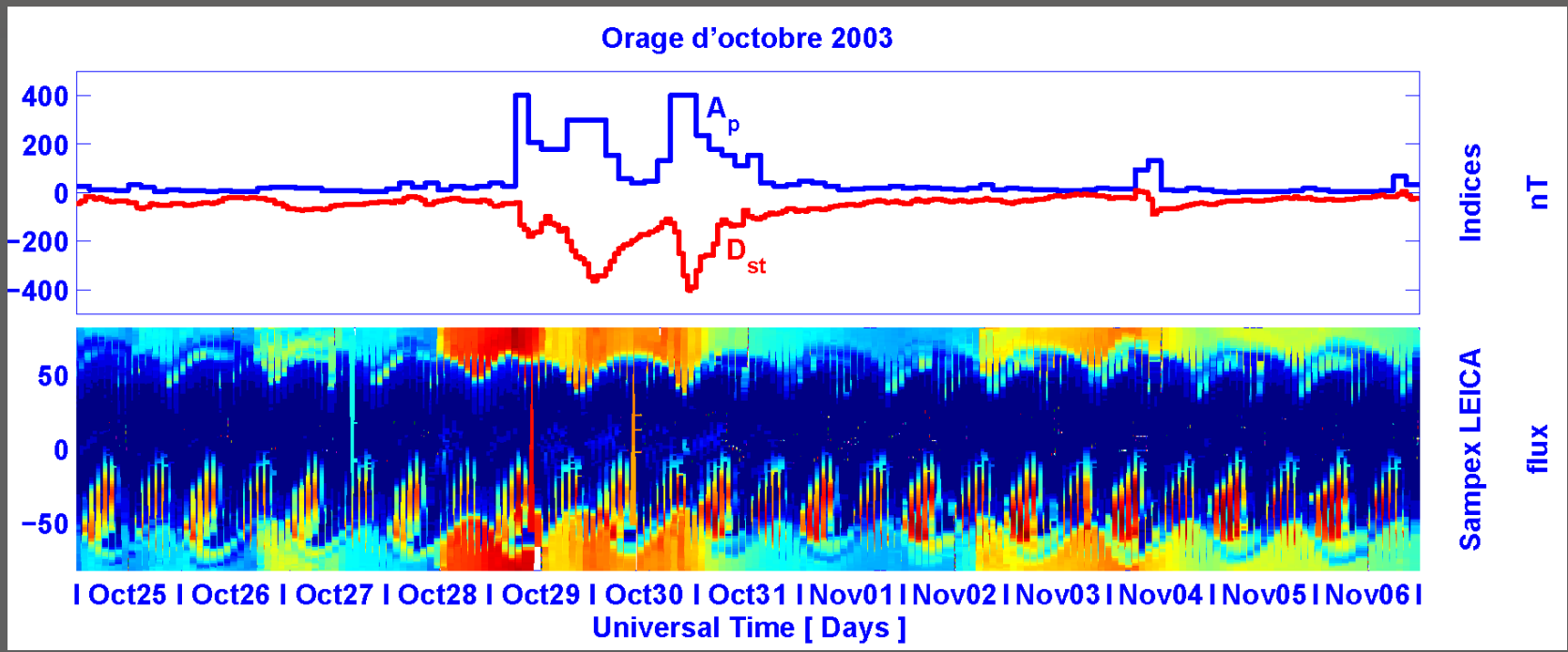
Detection of electrons with energies of few 100 keV in the auroral regions (North and South)

Such electrons can penetrate in the atmosphere down to altitude of 60-70 km

Nighttime chemistry in the lower mesosphere

$\Rightarrow$ NOx production only in the Arctic

# October – November event :




Stronger solar event, but s**maller $NO_2$ production !**

# Conclusion

Detection of large amount of $NO_2$ in the lower mesosphere produced by auroral electrons

Need of GOMOS data at the beginning of 2004 (level 2 and 1b) in order to better document the event

The retrieval of $NO_2$ could be better accurate with GOMOS than with MIPAS

Search of the frequency of such event